

## APPENDIX C

# TECHNIQUES FOR OPERATING EQUIPMENT IN THE DESERT

The effects of the desert environment on equipment were described in Chapter 1. This appendix describes techniques which, if used while operating equipment in the desert, can save both equipment and lives.

## DRIVING

Drivers and track commanders should observe the guidelines in the following paragraphs while operating vehicles in desert areas.

### Dusty Conditions

Wear goggles while driving open-hatched regardless of visibility. Clear-lens goggles should be worn at night unless night-vision goggles are used. Bandanas or surgical masks should be worn to avoid breathing heavy dust.

Vehicles in an extended convoy should maintain a dust distance of twice the normal interval, or as specified in the unit SOP to allow time for the dust to dissipate. When driving on extremely dusty roads or trails and if traffic conditions permit, a staggered column formation can be used with vehicles alternately driving on the left and right side of the road.

If the vehicles should become engulfed in dust, the convoy commander should consider adjusting the rate of march accordingly. Any commander of a vehicle engulfed in dust should alert the convoy commander by radio, move to the right side of the road, and stop or slow to allow the dust to dissipate. Extreme caution must be observed to ensure oncoming and following vehicles are not jeopardized. The lead vehicle must warn vehicles to return to column formation if encountering traffic.

## Sandy Deserts

Sandy deserts may be relatively flat or interspersed with windblown dunes. When driving in sand, the following techniques should be applied:

- The best time to drive on sand is at night or early morning when the sand is damp and traction is better. However, this is not always the case especially with the newer type military tires with closer tread design. Damp sand packs between the tread in the grooves of these tires resulting in virtually no surface traction.
- Drivers of track vehicles must be wary of a lack of steering response, which indicates sand is building up between the rear sprockets and treads. If the buildup of sand is allowed to continue, it will force the tread off. “Shaking” the vehicle with the steering or backing up will remove the sand.
- Wheel vehicles may gain some traction by reducing the air pressure in the tires. However, prolonged driving on partially deflated bias ply tires will overheat the tires and break down the sidewalls. Vehicles equipped with radial tires or central tire inflation system (CTIS) are not affected by the lower tire pressure if the maximum speed listed in the operator’s manual is not exceeded.
- Vehicle loads must be evenly distributed. Rear-wheel drive should be used where possible to prevent the front wheels from digging into the sand and becoming mired.
- Drivers must switch to all-wheel drive or change gears before a vehicle bogs down in the sand.
- Before entering the sand drivers should select a gear that will allow the vehicle to maintain as much torque as possible without causing the wheels to spin and to minimize changing gears.
- Large-wheeled vehicles, such as 5,000-gallon tankers, should have a designated “puller”. The designated vehicle should be preconfigured to assist these vehicles when they become bogged down in loose sand.

Some sand areas will be covered by a surface crust. This is caused by chemicals in the ground cementing sand particles together. In many cases it will be possible to drive on top of this crust and minimize dust signature and the chance of bogging down. Consider the following techniques when driving on a crust:

- Use staggered columns to facilitate movement. As a general rule vehicles should not follow one behind the other.
- Ensure vehicles maintain a minimum speed (determined from experience) below which they will break through the crust.
- Avoid sharp turns and abrupt starts or stops that could cause a vehicle to break through the crust.
- Reconnoiter patches of the crust that are a different shade to ensure they are not softer than the surrounding crust.

## **Crossing Dunes**

Crossing dunes requires careful reconnaissance. Normally, the upwind side of the dune will be covered with a crust and have a fairly gradual slope. The downwind side will be steeper and have no crust. Prior to crossing a dune, the driver should climb it on foot checking crust thickness, the angle at the crest to ensure the vehicle will not become bellied at the top, and the degree of slope and softness of the downwind side. If he is satisfied his vehicle can climb the dune, he should drive the vehicle straight up it at the best speed, crest it, and maintain a controlled descent on the other side.

Little hills may be formed by the wind blowing sand around small shrubs. Wheel vehicles should not attempt to move through areas where this has occurred without engineer assistance.

Cacti or thorn bushes will cause frequent tire punctures. Increase the number of tires carried in the unit's PLL when operating in areas covered with this type of vegetation.

## **Rocky Areas**

Rock and boulder-strewn areas, including lava beds, may extend for many miles. Desert rocks, eroded and sharp-edged, vary in size and are so numerous that it is almost impossible to avoid any but the largest. The subsequent harsh jolting fatigues individuals and causes extreme wear on tracks, wheels, springs, and shock absorbers. Rocks and stones can become lodged between the tires on vehicles equipped with disk that can cause severe damage to tires and brake components. Vehicles can follow one another in this type of terrain and it may be feasible to reconnoiter and mark a route. Drivers should achieve a "rolling" effect as they cross large rocks by braking as the vehicle's wheels ride over a rock so the axle settles relatively gently on the far side.

## **Salt Marshes**

Salt marshes (called sebkha) are normally impassable, the worst type being those with a dry crust of silt on top. Marsh mud used on desert sand will, however, produce an excellent temporary road. Many desert areas have salt marshes either in the center of a drainage basin or near the seacoast. Old trails or paths may cross the marsh, which are visible during the dry season but not in the wet season. In the wet season standing water indicates trails due to the crust being too hard or too thick for the water to penetrate. However, such routes should not be tried by load-carrying vehicles without prior reconnaissance and marking.

## **RECOVERY**

Track vehicle recovery methods are the same in the desert as in temperate climates. The techniques described in the following paragraphs will assist wheel

vehicle recovery operations in sand crusts or salt marshes. To assist in recovery, wheel vehicles should carry the following items:

- Steel or aluminum channels, at least for the driving wheels. These are pierced to reduce weight and ribbed for strength. Pierced steel planking (PSP) or galvanized iron may be used as a substitute.
- Sand mats made of canvas, preferably with lateral strips of metal to give strength and increase the traction of the wheels.
- Jacks and jack blocks.
- Tow rope(s).
- Shovels.

Once a vehicle becomes mired, excavate the ground under the vehicle in a gradual slope towards the direction of recovery to a point where no part of the underside is touching the ground. Channels or spurs and mats are laid under or against the wheels facing the direction of recovery. Tire pressure may be reduced to increase traction, but this also lowers the vehicle. It may be necessary to lift the wheels with a jack if the vehicle is resting on its frame or axles.

When the vehicle begins to move, any faltering will cause it to sink again. Once out, the driver must maintain speed until the vehicle has reached the nearest hard area. At this point the tires are reinflated, the vehicle inspected for damage, and recovery equipment collected.

Vehicles equipped with winches can winch themselves out using ground anchors. The ground anchor may consist of a tarpaulin full of sand placed in a hole and the winch cable attached to it, or it may be one, or preferably two spare wheels well dug in.

A rubberized fabric balloon may be used on light vehicles to lift them free of broken crust. The balloon is placed under the vehicle and blown up with the vehicle exhaust.

If a lone vehicle breaks or bogs down in the desert, the crew must stay with it. A vehicle is much easier to find than a lone man.

## MAINTENANCE

Equipment directly affected by heat, such as aircraft and radios, are equally affected by all deserts. However, power trains and suspension systems are affected in proportion to trafficability and soil texture. Most damage to equipment can be avoided by careful driving and by careful observation by vehicle commanders.

Track tension must be correct as constant driving on rocky plateau deserts will reduce the life of the track. Suspension units will require frequent replacement

of torsion bars and suspension arms. To prevent damage to internal parts of the idler and suspension arms caused by the terrain, direct-support maintenance units must be provided with equipment capable of tapping and removing the sheared bolts.

To prevent problems that can result when desert vegetation clogs engine oil coolers and cylinder cooling pins, place a small-mesh wire screen over the top grille doors. It may still be necessary to remove packs about every 10 days to clean the engine cooling fins. The wire screening should be periodically checked, removed, and cleaned.

Maintenance personnel must inspect and adjust transmission bands frequently, especially on vehicles operating in hot, barren mountains. This will help reduce transmission overheating.

Extra stocks of air-cooled generators are necessary because high-ambient temperatures limit their ability to maintain the proper operating temperature and contribute to premature failure.

## WHEELED VEHICLES

Wheeled vehicles are subject to brake system component failures and power steering leaks on rocky deserts. Vehicles equipped with manual transmissions are prone to clutch failure caused by drivers slipping the clutch. Vehicles with automatic transmissions tend to overheat; therefore, stop frequently to allow the transmission time to cool. The M54 5-ton truck is prone to air hydraulic cylinder failure and power steering seal leaks on rocky deserts. All vehicles of the 1/4- to 5-ton range are prone to clutch failure caused by drivers “riding” the clutch pedal. Tire consumption is very high, so all vehicles must carry one, or preferably two spare tires, and the unit’s PLL of tires should be considerably increased. Approximately one vehicle in every three to four should carry slave cables to provide for battery failure.

Vehicles should be equipped with the following:

- Extra fan belts,
- Two spare tires.
- Extra oil.
- Extra radiator hoses.
- Heavy duty tape.
- Extra air and fuel filters.
- Jack stand support plate.
- Sand ladders (fabricated) and matting.

**NOTE: The M113A1 is especially susceptible to overheating problems in desert conditions. This includes the transmission and the solid-state voltage regulator, which is more prone to overheating and early failure than the older mechanical type.**

- Towrope/cable.
- Extra water cans.
- Siphoning hose and funnel.
- Slave cables.

## RADIOS

Radios, regardless of type, must be kept cool and clean. They must be in the shade whenever possible and should be located in a ventilated area (or even in an air-conditioned can). If water is available, wrap the radio in a damp towel, ensuring that the air vents are not blocked. Additional radios should be available in vital communications centers, such as tactical operations centers, to allow immediate replacement if the set in use shows signs of overheating.

It is essential that antennas be cut or adjusted to the length of the operating frequency. Directional antennas must be faced exactly in the required direction; approximate azimuth produced by guesswork will not do. A basic whip antenna relies on the capacitor effect between itself and the ground for efficient propagation. The electrical ground may be very poor, and the antenna performance alone may be degraded by as much as one-third if the surface soil lacks moisture, which is normally the case in the desert. If a ground-mounted antenna is not fitted with a counterpoise, the ground around it should be dampened using any fluid available. Vehicle-mounted antennas are more efficient if the mass of the vehicle is forward of the antennas and is oriented towards the distant station.

Desert operations require dispersion, yet the environment is likely to degrade the transmission range of radios, particularly VHF (FM) fitted with secure equipment. This degradation is most likely to recur in the hottest part of the day, approximately 1200 to 1700 hours.

If stations start to lose contact, especially if the hotter part of the day is approaching, alternative communication plans must be ready. Alternatives include the following:

- Using relay stations, including an airborne relay station (the aircraft must remain at least 4,000 meters behind the line of contact). Ground relay stations or RETRANS are also useful and should be planned in conjunction with the scheme of maneuver.
- Deploying any unemployed vehicle with a radio as a relay between stations.
- Using alternative radio links such as VHF multichannel telephones at higher levels, or HF (SSB) voice.
- Using wire. Normally wire will not be used as operations will be fluid, but it maybe of some value in some static defensive situations.

- Using a unit such as all or part of the task force scout platoon for messenger service, Although it is undesirable to use such a unit in this manner, it may be necessary to maintain communications.

## GENERAL TIPS

General tips for operating equipment in the desert include the following:

- Check track tension daily.
- Check drive belt adjustment frequently.
- Lubricate suspension items daily, and clean grease fittings.
- Reduce sand ingestion by stretching nylon stockings over air cleaners.
- Emphasize proper engine cooldown and shutdown procedures, especially diesels.
- Adjust battery specific gravity to the environment (refer to TMs).
- Set voltage regulators at lower end of specifications.
- Start up vehicles regularly to prevent discharge of batteries.
- Increase stocks of oils and lubricants.
- Use high-grade 20W-50 oil; it serves well under desert conditions.
- Compensate for increased pressure due to severe heat in closed pressurized systems.
- Check lubrication orders and TMs for the correct viscosity of lubricants for higher temperatures.
- Keep lubrication to the absolute minimum on exposed or semiexposed moving parts; this includes working parts of weapons.
- Erect screens against blowing sand in maintenance areas.
- Cover the gap between the fuel nozzle and the fuel tank filler neck opening during refueling operations.
- Protect exposed electrical cables and wires with electrical tape.
- Keep optics covered; clean them with a soft paintbrush or a low-pressure air system (this works well for weapons also).
- Clean sand and dirt from hulls of armored vehicles.
- Check tire pressures and fuel levels at the midpoint of the temperature range during the day.
- Ground all refueling equipment—STATIC ELECTRICITY KILLS.
- Replenish radiators with potable water whenever possible.
- Determine battery shortages early and requisition early.
- Drain fuel lines at night and in the morning due to condensation.

- Increase PLLs for the following parts due to high failure rates:
  - Tires.
  - All track components.
  - All suspension components for both wheel and track vehicles.
  - Brake shoes.
  - Bearings and bushings.
    - Plastic and rubber parts, including seals.
  - All filters.
  - Generator components.
- Deploy with plastic bags to cover weapons and protect other equipment during maintenance or when not in use.
- Bring muzzle plugs.
- Prepare all vehicles for desert operations in accordance with the appropriate TMs.
- Issue small paintbrushes to all soldiers/marines for weapons cleaning and other equipment maintenance. The paintbrush is one of the more valuable tools available to the soldier/marine for maintenance.